

IX. *The development of Ceroplastes roseatus*, Towns. and Ckll. By CHAS. H. DOLBY-TYLER, F.E.S., British Consul, Panama.

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PLATE VIII.

*Ceroplastes roseatus*, Townsend and Cockerell (Journ. New York Entom. Soc., vol. vi, p. 176, September 1898. Ref. Ann. and Mag. Nat. Hist., ser. 7, vol. iii, p. 167, February 1899).

ON the suggestion of Professor Cockerell, to whom I am much indebted for kind encouragement and assistance in prosecuting my study of the *Coccidæ*, I undertook in December last to record the development of the exceedingly pretty species that forms the subject of the present paper.

Upon leaving the parent scale the young insects crawl for a short distance along the branch or twig and settle down almost immediately. Having placed some upon the upper surface of a leaf, they wandered over it for upwards of three hours, and eventually reached the twig whereon they fixed at once.

Twenty-four hours after fixation three faint mealy secretions appeared upon the head, thorax, and abdomen respectively, and during the following six hours assumed definite form; the cephalic patch being sub-cylindrical and higher than the rest; the thoracic patch divided transversely into three ridges representing the pro-, meso-, and meta-thoracic terga—the first being somewhat of a shallow inverted horse-shoe shape; and the abdominal patch was divided into seven distinct transverse ridges, narrowing posteriorly, which represented the visible tergites. Ten hours later, or forty after fixation, appeared the first indications of the marginal plates—so conspicuous in the advanced larval condition—in the form of two minute irregular patches of secretion situated upon the margin on either side of the thorax close to the pro- and meso-thoracic, and the meta-thoracic and abdominal sutures (Plate VIII, fig. 1). The colour of the insect's body, which

originally was a claret or light maroon, had changed to a fulvous brown, and incipient development of the dorsal tubercle was apparent in the more convexed and elevated dorsum.

The patches of dorsal secretion continued to grow, the pro- and meso-thoracic ridges uniting in a well-defined quadrangle, and several of the abdominal ridges becoming confluent, until ten hours later they had attained a height equal to that of the dorsum. During the ensuing fourteen hours the quadrangular mass became cubical with a concavity in its upper surface; posterior to, and springing from the base of the cube, another ridge of secretion had arisen and united accurately with the meta-thoracic tuft; and all the abdominal ridges were confluent and serrated at their margin, showing on either side six incisions corresponding to the tergal sutures. Though distinct, the divisions between the regional masses of secretion was inconsiderable. Six hours subsequently a number of scattered nascent secretions appeared laterally cephalad of the thoracic marginal tufts; between the thorax and abdomen a parallel and almost confluent ridge of secretion appeared, inclined forward and united at its apex with that of the meta-thorax; while between the pre-caudal lobes a short median film of secretion was visible. Thirteen hours later several small patches had appeared, marginally laterocaudal. At this stage in one of the insects under observation I noticed a relatively large drop of a transparent fluid ejected dorsally from between the anal plates.

Two days later (to be precise, 130 hours after fixation) the thoracic masses had united, becoming sub-conical and inclined cephalad; the lateral incisions of the abdominal tuft had disappeared; and the marginal tufts could now be traced, although as yet the caudo-laterals had not assumed definite form. The body of the insect, now reverted to its original maroon colour, was visible only as an ovoid fascia separating the dorsal and marginal tufts, and united at its narrower diameter by the naked thoraco-abdominal suture.

The day following the marginal tufts, fifteen in all, were quite distinct, there being six projecting laterally from either side; one cephalad, below the cephalic tuft; and one projecting posteriorly from beneath each pre-caudal lobe. Meanwhile, the growth of the cephalic tuft

appeared to be arrested, or advanced in an imperceptible degree. Three days subsequently the abdominal secretion had attained a height of .50 mm., and the insect presented the appearance given in Fig. 2, *a, b*. At this stage the shallow perpendicular fluting and horizontal striæ of the abdominal tuft were more pronounced than at any other.

Eight days later the pre-caudal setæ, which up till then were constant, had disappeared, and the surface of the lobes was sparsely sprinkled with secretion; the tubercles, three on either side subdorsally, and one cephalad, all co-equal in size, could just be distinguished; while the anal plates had fused into a sub-cylindrical spine.

Four days afterwards the insect presented a somewhat flattened convex, ovate appearance; the marginal tufts appearing as a broad raised band, narrowed caudad, divided by deep indentations into light distinct plates (Fig. 3), there being one cephalad composed of the cephalo-marginal, cephalic, and first pair of lateral tufts; three lateral pairs, the last of which was formed through evalescence of tufts 4, 5; and one caudad made up of No. 6 and the precaudal tufts and surface secretions. The dorsal tufts had united forming a compact ovate, truncate, conical mass, and a faint secretion appeared between this and the marginal plates. The first step towards the elaboration of true wax was now apparent, the substance of all the plates being consolidated, each one showing a disappearing apical tuft of primitive secretion.

From this period for the ensuing eight days no apparent external growth of secretion was visible; meanwhile, however, the elaboration of true wax continued, and at the expiration of this period the base of each plate was composed of a homogeneous mass of pink-hued wax, and the interstices half filled with it, so that the insect's body was now completely hidden from view with the exception of the anal process, a small portion of which projected through the waxy covering.

Five days later the fusion of secretion had much advanced, the whole test was widened and nearly circular. Seen from above the central plate appeared slightly polygonal, somewhat longer than broad, and viewed in profile, laterally, its apex is seen to be inclined cephalad. The marginal plates are conical and the caudal plate, the growth of which appears to be arrested mediad, has commenced to merge on either side into No. 3.

A week subsequently the caudal plate was entirely merged into No. 3, and the insect, which now measures externally 3 mm. in length, presents seven well-defined plates. The apical tufts of snowy white secretion, which contrast so noticeably with the roseate hue of the waxy plates, are very minute and in many instances have disappeared entirely.

During the ensuing fortnight the secretion of wax proceeds rapidly, the sutures between the plates are completely filled, and the end of the stout anal process is visible as only a small black point. The insect has attained a length of 6 mm., on an average, and appears as in Fig. 4. At this stage the rosy colour is most pronounced at the recently filled sutures, and its existence would seem in part due to the translucence of the newly-formed wax allowing partial transmission of the deep maroon colour of the living insect beneath.

A fortnight later, almost exactly ten weeks from the date of fixation, the ♀ had arrived at maturity and the test was fully formed, presenting the appearance described by Messrs. Townsend and Cockerell, with one addition, viz.—that in the smaller and more perfectly formed specimens (Fig. 5) the apex of the test is mucronate and curved cephalad.

The rate of growth of individual insects varies considerably, their relative position upon a branch appearing to have a marked influence upon development; those nearer the main stem or trunk seemingly thrive better than others farther removed. The largest fully-formed test in my series measures long. 10 mm., trans. 8 mm., alt. 6 mm., and the smallest  $3\frac{5}{16} \times 3 \times 2$  mm., both being of the same generation. Very few arrive at maturity owing to the attacks of various parasitic Hymenoptera, amongst which, however, I have succeeded in rearing only one, *Lecaniobius cockerellii*, Ashm. They are also preyed upon by the larvæ of a Coccinellid, *Azya luteipes*, Muls.

There are four broods a year, but owing to the causes mentioned above their colonies are kept within very narrow limits, and considered economically they are innocuous.

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#### EXPLANATION OF PLATE VIII.

[See explanation facing the PLATE.]